PART OF TEST EQUIPMENT IE-46A

ARMY AIR FORCES
TECHNICAL ORDER No. 08-10-107

INSTRUCTION BOOK

FOR

OPERATION and MAINTENANCE

OF

FREQUENCY METER BC-906-C

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MANUFACTURED BY
PHILCO CORPORATION
PHILADELPHIA, PA.

ORDER No. 811-WF-42

RESTRICTED

PUBLISHED BY AUTHORITY
OF
THE CHIEF SIGNAL OFFICER

NOVEMBER 25, 1942

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REPORT OF MAJOR FAILURE

In the event of major failure of any of the component units of this equipment a report shall be submitted in the form indicated below. Copies of this report shall be forwarded to the Chief, Signal Section, Air Service Command, Patterson Field, Fairfield, Ohio, and to the Director, Signal Corps Aircraft Signal Service, Wright Field, Ohio.

1. Contract or order number .....
2. Organization and station .....
3. Nomenclature of equipment .....
4. Nomenclature of component unit .....
5. Date and nature of failure .....
6. Type of airplane in which installed .....

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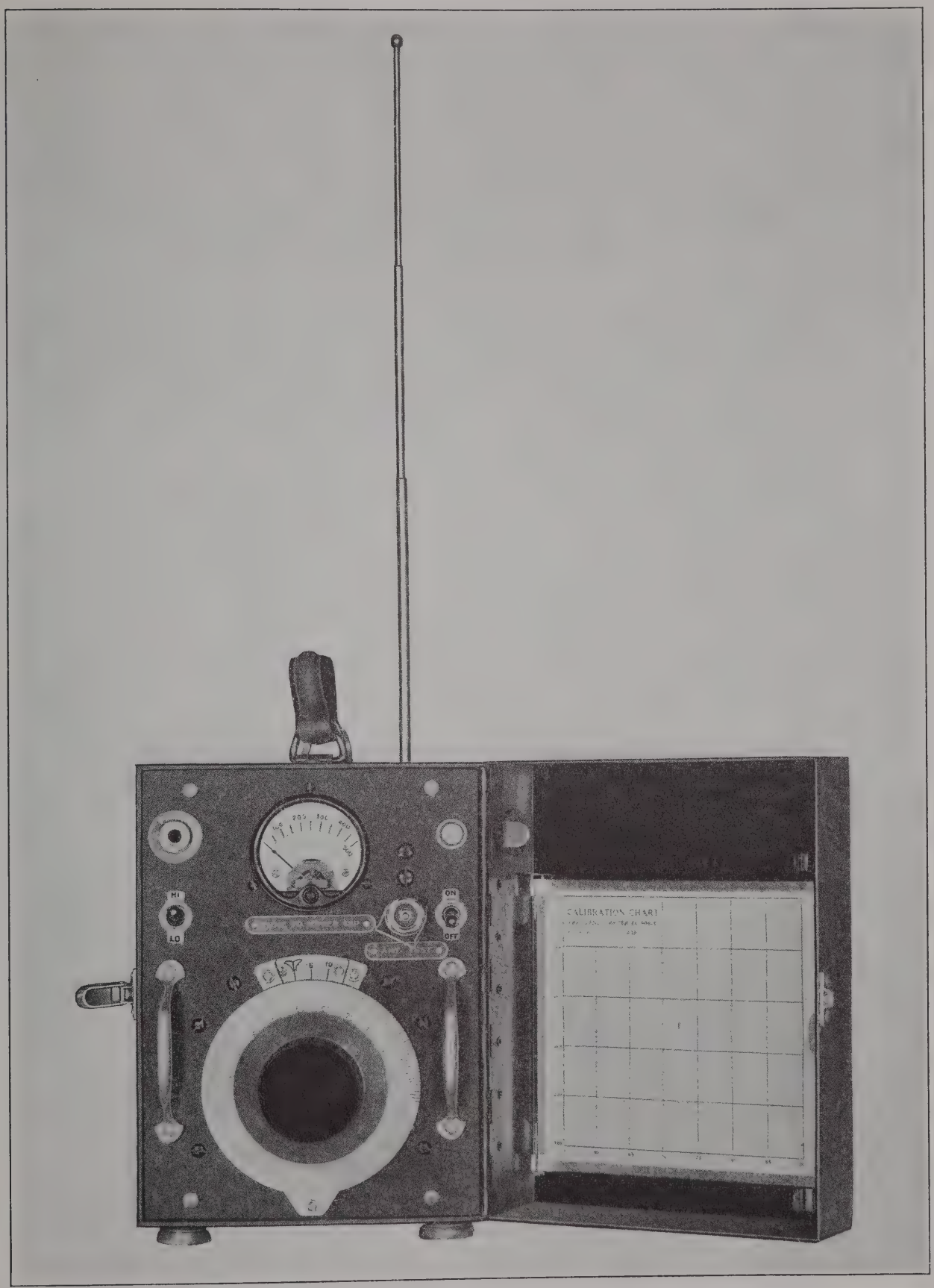

FIGURE 1—FREQUENCY METER BC-906-C, FRONT VIEW, DOOR OPEN AND ANTENNA IN PLACE

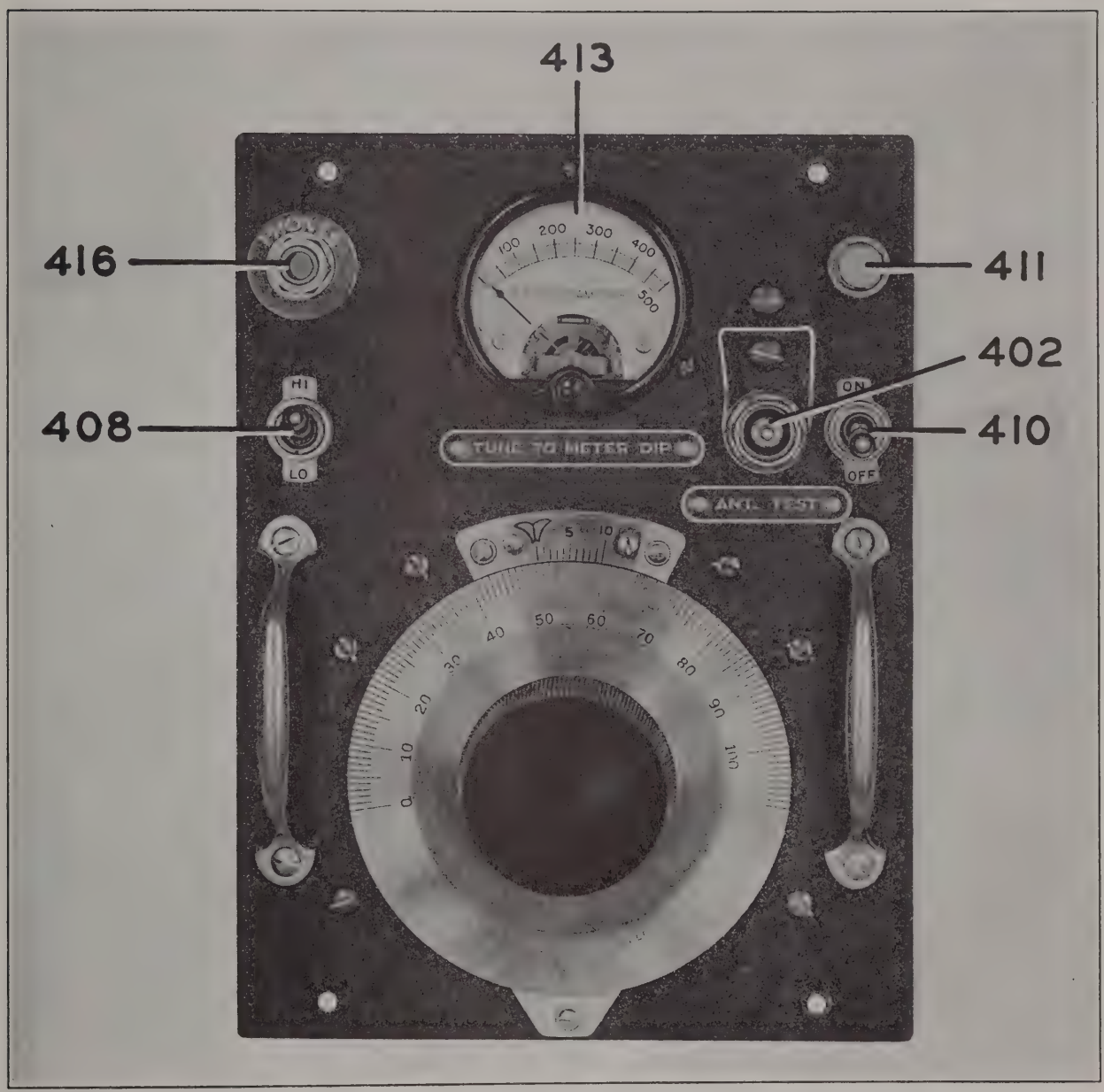

FIGURE 2—FREQUENCY METER BC-906-C, PANEL VIEW, CASE REMOVED

SECTION I

GENERAL DESCRIPTION OF FREQUENCY METER BC-906-C

1. Use

Frequency Meter BC-906-C is an absorption-type frequency meter intended for use with Radio Receiver BC-1066-A. It may be used either to determine the frequency of an oscillating receiver or a signal generator, or it may be used to tune a signal generator or an oscillating receiver to a desired frequency.

2. Case

The instrument is housed in a black, wrinkle-finished metal cabinet fitted with a door. When closed, this door not only protects the dial, meter, etc., which are mounted on the panel, but through the action of an automatic push-button switch, assures the operator that the power is turned off.

3. Antenna

Mounted inside the door is a calibration chart and the extendible type ANTENNA, which is used with Frequency Meter BC-906-C. When the frequency meter is being operated, the antenna is plugged into its socket through a hole in the top of the instrument case. It may be extended to its entire length or it may be used only partially extended. The sensitivity of this meter varies with antenna length. If necessary adjust the length of the antenna for maximum sensitivity.

4. Panel

Mounted on the panel is a friction, vernier-drive DIAL, which is equipped with a vernier attachment enabling the scale to be read in tenths of a division. Also mounted on the panel are: a microammeter which shows a minimum reading when the instrument is at resonance with a source of radio-frequency energy; a SOCKET for a co-axial connector (Terminal TM-201), which is wired in parallel with the antenna socket mentioned above; an "OFF" "ON" switch; and a "HI" "LO" switch, used to vary the sensitivity of the frequency meter.

5. Batteries

Frequency Meter BC-906-C is completely self-contained, for the batteries used in the operation of the instrument are contained in a battery compartment located within the meter. Two batteries are required: one 1½ volt "A" battery (Battery BA-35) and one 45-volt "B" battery (Battery BA-53-A).

6. Installation of Batteries

These batteries are installed in the battery box as follows:

a. Loosen the DZUS fastener at the rear of the meter housing.

b. Remove the four screws at the four corners of the panel.

c. Slide the frequency meter out of its case.

NOTE: THE ANTENNA MUST BE REMOVED FROM ITS SOCKET ON THE TOP OF THE FREQUENCY METER BEFORE THE CASE CAN BE REMOVED.

d. Remove the cover of the battery box (the black box located on the top of the instrument).

e. Connect the **green** "+1.5" volt lead to the "+" terminal on Battery BA-35, and the **blue** "−1.5" volt lead to the "−" terminal on Battery BA-35.

f. Insert Battery BA-35 into the battery box with the terminals toward the front of the meter as shown in Figure 4.

g. Connect the **red** "+45" volt lead to the "+45" terminal on Battery BA-53-A.

h. Connect the **yellow** "–45" volt lead to the **negative** terminal on Battery BA-53-A.

i. Slide Battery BA-53-A edgeways into the battery box (in the position shown in Figure 4). Do not force. If it is necessary to force Battery BA-53-A into place, then Battery BA-35 has not been correctly installed.

j. Replace the top of the battery box.

k. Replace Frequency Meter BC-906-C in its cabinet.

l. Fasten the DZUS fastener at the rear of the cabinet and replace the four screws through the panel.

m. Be sure to get the meter right-side up in its cabinet so that the antenna socket will be on top.

7. Weight

The weight of Frequency Meter BC-906-C, complete, is 17.8 pounds.

8. Components

Principal components of Frequency Meter BC-906-C include the following:

Extendible type antenna
Tube VT-172 (IS5)
Battery BA-35
Battery BA-53-A
Calibration Chart

SECTION II

PREPARATION FOR USE

9. Procedure

In attempting to operate this equipment, the following instructions should be followed:

a. Open the door to Frequency Meter BC-906-C.

b. Remove the extendible-type antenna from its clip just inside the door, extend it to its full length and insert it through the hole in the top. Be sure that the base of the antenna is firmly in the socket.

c. Throw the "OFF" "ON" switch to the "ON" position.

d. **For use with low-power signal generators and oscillating receivers, set the "HI" "LO" switch on "HI."**

e. Check the meter deflection; it should be around 400 to 450 divisions on the microammeter scale. If deflection is not well above 250 on the meter scale, check the battery voltages with a 1,000 ohms-per-volt voltmeter in accordance with paragraph 10 of SECTION III. If the microammeter reads low, but the battery voltage is satisfactory, the tube should be replaced in accordance with paragraph 11 of SECTION III.

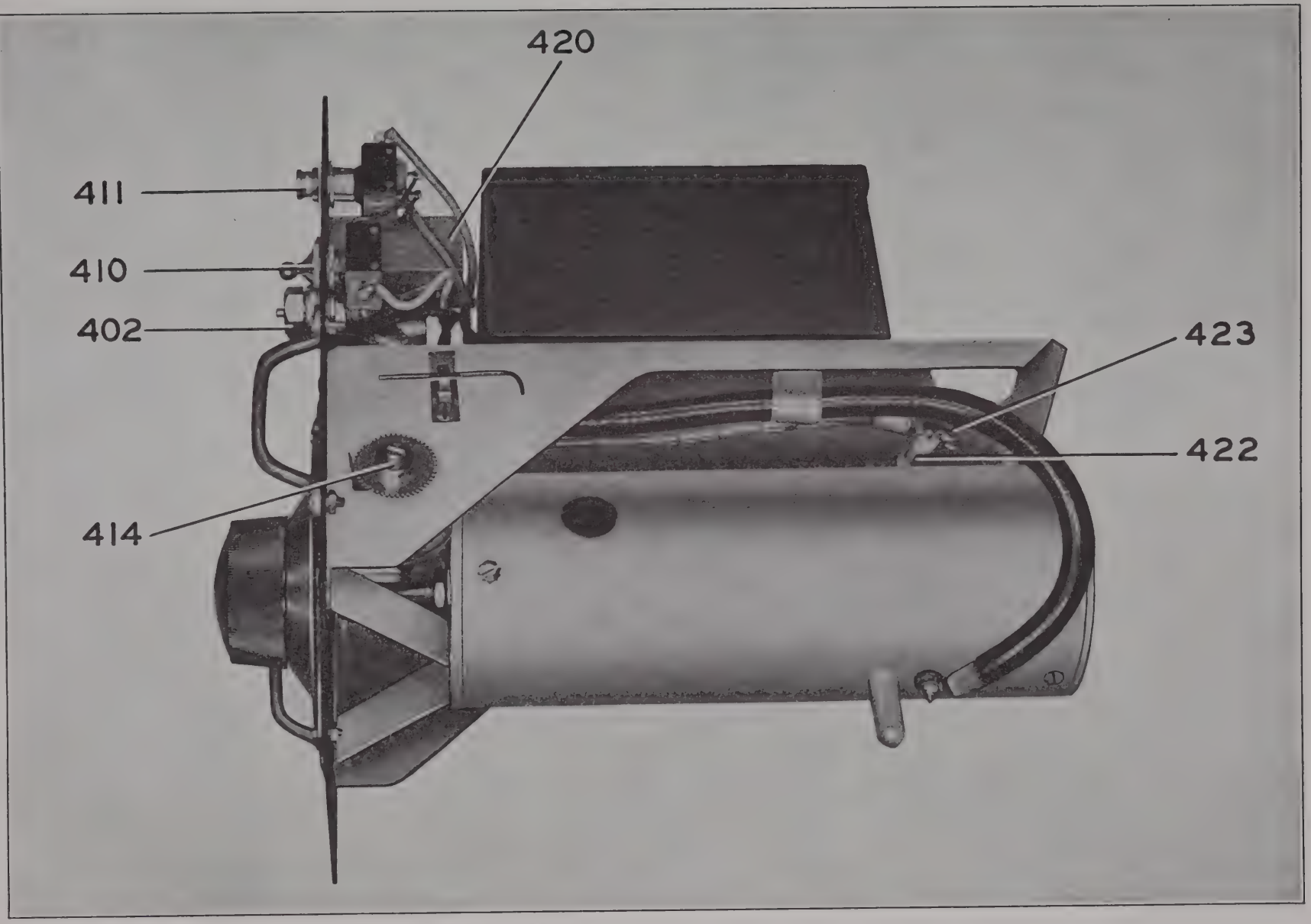

FIGURE 3—FREQUENCY METER BC-906-C, RIGHT-SIDE VIEW, CASE REMOVED

SECTION III

MAINTENANCE

10. Checking Batteries

The battery voltages should be checked as follows:

a. The frequency meter should be turned on 5 or 10 minutes before carrying out the subsequent procedure.

b. Remove the frequency meter from its case (see a, b, c, of paragraph 6, SECTION I).

c. Note switch terminals in upper right-hand corner behind panel. The red-coded lead is connected to "+45" terminal of the "B" battery; the green-coded lead is connected to "+1.5" terminal of the "A" battery.

d. A prod from a voltmeter may be touched to these terminals and the circuit completed to the panel for measuring the battery voltages. The "A" battery voltage should not be less than 1.2 volts; the "B" battery voltage should not be less than 40 volts. If voltages are lower than these values, the battery should be replaced in accordance with SECTION I, paragraph 6.

11. Replacing the Tube

a. Replace the questionable tube by one known to be good.

b. Note Item 414 of Figure 3, a rheostat used as a shunt for the meter. This rheostat has a screw for screw driver adjustment. When the frequency meter is removed from its case, this adjusting screw can be seen by looking at the side of the frequency meter. With the frequency meter turned on, and with no signal input to the frequency meter, this screw should be adjusted so that a deflection of 450 is obtained on the meter.

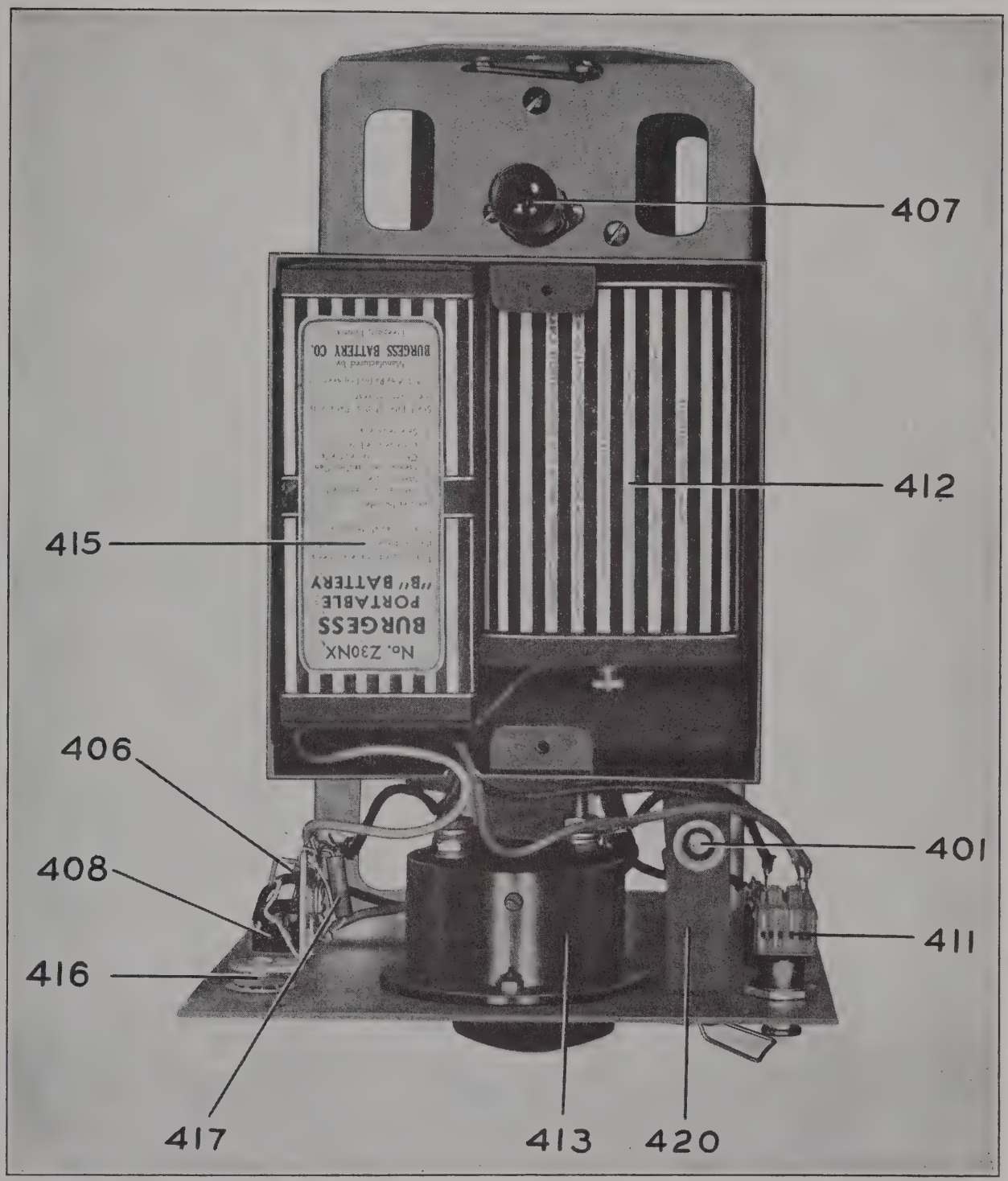

FIGURE 4—FREQUENCY METER BC-906-C, TOP VIEW, CASE REMOVED

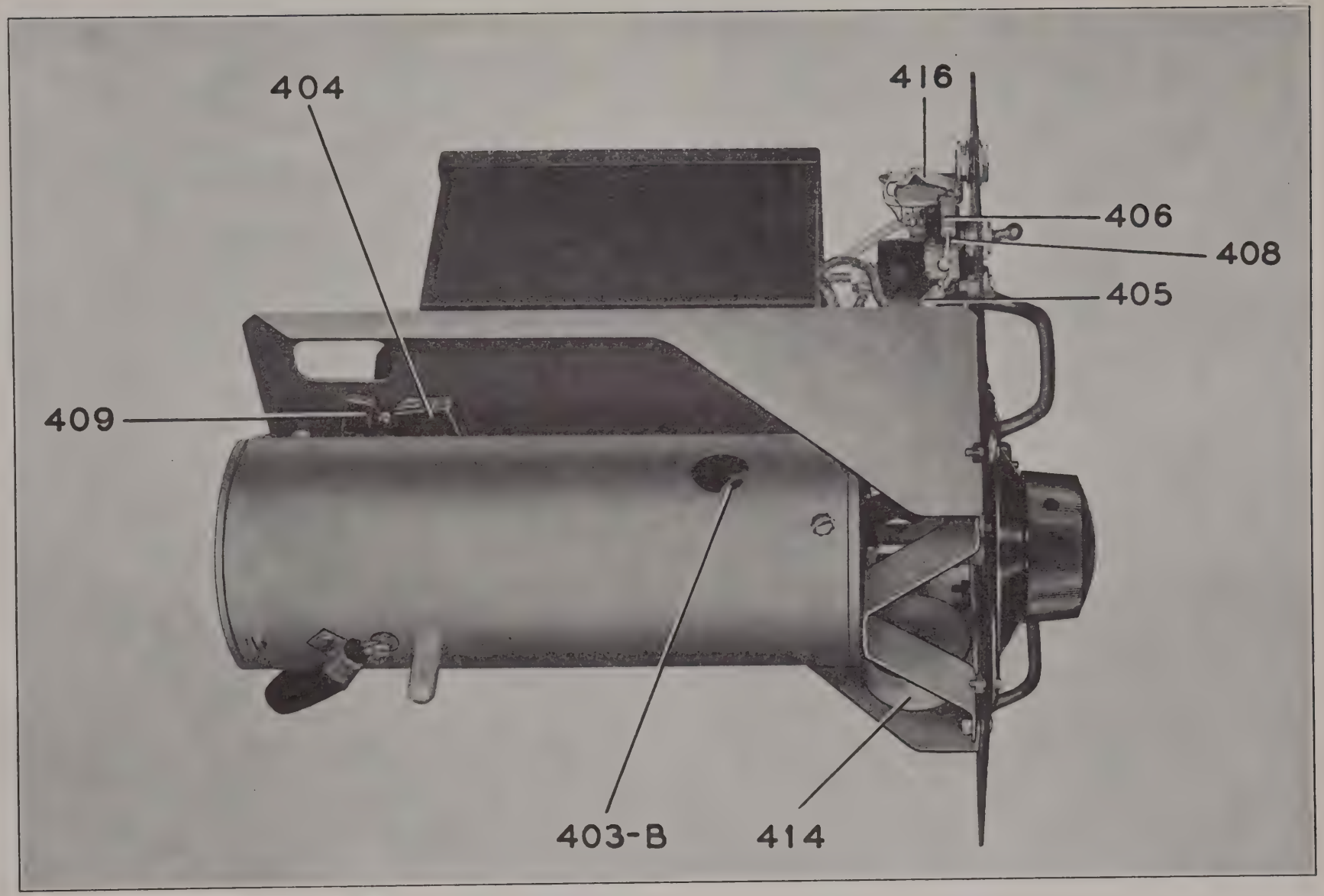

FIGURE 5—FREQUENCY METER BC-906-C, LEFT SIDE VIEW, CASE REMOVED

SECTION IV

SUPPLEMENTARY DATA

12. Tube Characteristics

TUBE VT-172 (Commercial Type IS5)

(Pentode Unit)

Filament voltage	1.4
Filament current (amps.)	0.05
Plate voltage (max.)	90
Screen voltage (max.)	90
Grid voltage	0
Plate current (ma)	1.2 (with 45 volts plate supply)
Screen current (ma)	0.3 (with 45 volts screen supply)
Plate resistance (ohms)	500,000 (approximate)
Transconductance (micromhos)	525 (with plate and screen supplies at 45 volts)

NOTE: The diode is located at the negative end of the filament and is independent of the pentode unit except for the common filament.

BASING: Looking at the bottom of the tube—(pins are numbered in the following beginning with Pin No. 1, the first in a clockwise direction from the blank space, and continuing about the base in a clockwise direction).

Pin No. 1	Filament –
Pin No. 2	No Connection
Pin No. 3	Diode Plate
Pin No. 4	Pentode Screen
Pin No. 5	Pentode Plate
Pin No. 6	Pentode Grid
Pin No. 7	Filament +

TABLE OF REPLACEABLE PARTS

Ref. No.	Signal Corps Stock No.	Name of Part	Description	Function	Supplier	Drawing Numbers		
						Supplier	Philco	Signal Corps
FREQUENCY METER BC-906-C								
401		Antenna Socket	Threaded-mounting; single spring contact. Spring, beryllium copper; shank, brass; nickel plated. 4-36 threads for 7/16"; spring, 25/32". Spring when compressed to fit 0.169" diameter hole. (Ucinite Type 152063, or equal.)	Attach extendible type antenna	UCIN	152063	258-6190	
402		Terminal TM-201	Co-axial socket. For Coupling MC-320, or Coupling MC-277 (British Type 10H/528) panel mounting.	For attachment of external antenna	AMPH		358-1615	
403-A		Capacitor, variable	4-plate; 2 stationary; 2 rotary, soldered to rotor shaft, silver plated, ceramic end plates. Single hole mounting, 3/8"-32 thread, 13/16" long. Hex. nut, 1/4" shaft, with 0.094" hole, 1.437" from mounting base. Length of shaft and mounting to front plate, 1 3/4". Connection lugs at rear. Capacity 4.3 mmf. minimum; effective maximum 13.6 mmf. ±0.5 mmf.; absolute maximum 17.9 mmf. Philco Part No. 351-1039. 2 3/4" x 1 27/64" x 1 3/64" overall.	Tuning resonant circuit	OAK	676-S7	Part of 358-2770	
403-B		Capacitor, variable	1.5 mmf. minimum, 7 mmf. maximum. Trimmer Type NP (Erie Resistor Corp. Style TS-2-A); 41/64" x 55/64" x 3/8" ceramic. Philco Part No. 351-1033.	Calibration of 403-A	ERIE	NPO-TS2A	Part of 358-2770	
404		Capacitor,	Mica, 5000 mmf. ±10%; XM262 bakelite molded case; pigtail terminals. Approx. dimensions, 3/4" x 3/4" x 1/4". 300 v d-c wo. v	Diode load by-pass	MCAM ELMO	WXM 502L	60-250634	
405		Resistor	1.5 megohms ±10%; 1/2 watt carbon, insulated; pigtail terminals. Approx. dimensions, 5/8" x 3/16".	Diode load	STAC IRC	MB-1/2	66-5153340	

Ref. No.	Signal Corps Stock No.	Name of Part	Description	Function	Supplier	Drawing Numbers		
						Supplier	Philco	Signal Corps
FREQUENCY METER BC-906-C—Continued								
406		Resistor	0.47 megohms ±10%; ½ watt carbon, insulated; pigtail terminals. Approx. dimensions, 5/8" x 3/16"	Diode load	STAC IRC	MB-½	66-4473340	
407		Tube VT-172	Diode-pentode "button" base (IS5)	Rectifier, amplifier	KENR SYLV TUNG	IS5 IS5 IS5	453-1368	
408		Sensitivity switch	Toggle switch, SPDT. similar to Arrow-Hart & Hegeman Elec. Co. Type 21349, except threaded mounting bushing to be 11/32" long. To be supplied with hex. nut and knurled ring nut. (As made by The Arrow-Hart & Hegeman Electric Co., Hartford, Conn. or equal) ½" single-hole mounting, 1 9/16" x 5/8" x 1 5/16" overall	Vary sensitivity of instrument	AH & H	21349	452-1045	
409		Capacitor	Mica, 50 mmf. ±10%; XM262 bakelite molded case; pigtail terminals. Approx. dimensions, 7/16" x 11/16" x 3/16". 300 v d-c wo. v	Filament r-f by-pass	MCAM		60-050637	
410		Switch	Toggle, DPST. Similar to Arrow-Hart & Hegeman Electric Co. Type 20902, except threaded mounting bushing to be 11/32" long. To be supplied with hex. nut and knurled ring nut. (As made by Arrow-Hart & Hegeman Electric Co., Hartford, Conn., or equal) ½" single hole mounting, 1 9/16" x 1 5/8" x 1 5/16" overall.	"OFF" "ON" switch	AH & H	20902	452-1035	
411		Switch	"Push-to-break" DPST; both circuits normally on. To be supplied with hex. nut, one knurled ring nut, and one lockwasher. (The Arrow-Hart & Hegeman Electric Co., Type 20908 or equal). ½" single hole mounting. 1 5/16" x 5/8" x 1 11/16" overall	Automatic switch (opens battery circuit when door is closed)	AH & H	20908	452-1036	

Ref. No.	Signal Corps Stock No.	Name of Part	Description	Function	Supplier	Drawing Numbers		
						Supplier	Philco	Signal Corps
FREQUENCY METER BC-906-C—Continued								
412		Battery BA-35	1½ volt dry cell Burgess 4 FH or equivalent	Heat filament	BURG GEND	4FH	461-1001	
413		Meter	0 to 500 microammeter; 2¼" round flush bakelite case; $1\frac{31}{32}$" scale length. Terminals to be $\frac{23}{32}$" in length. De Jur Type 210. (As made by De Jur Amsco Corp., Sheldon, Conn., or equal.) 2¾" x 2⅛" overall. 60 degree mounting holes, one on vertical axis at top, ⅛" in from edge	Show resonance point	DEJA	210	455-1015	
414		Rheostat, gear and detent assembly	500 ohms +30% −10%, carbon, linear. 280 degrees rotation. ¼" slotted shaft. Length of shaft and mounting, $1\frac{3}{16}$". Single hole mounting ⅜"-32 thread. ⅜" long, $1\frac{13}{16}$" length x $1\frac{9}{32}$" diameter. (Philco Part No. 353-5069.) Rheostat and detent mounted together as one item	Vary meter reading	PC		358-2769	
415		Battery BA-53-A	45 volt dry cell Burgess Z-30-N or approved equivalent	Supply plate voltage	BURG GEND	Z-30-N	461-1002	
416		Phone jack	Mallory Midget Type A-2, or equal; to fit Plug PL-55; 1" x $1\frac{19}{32}$"; ⅜-32 thread mounting $\frac{5}{16}$" long, equipped with hex. nut. Single contact break, contact insulated	Phone connection	MALLO CHIT	A-2	358-1195	
417		Resistor	2200 ohms ±10%; ½ watt; carbon, insulated, pigtail terminals. Approx. dimensions ⅝" x $\frac{3}{16}$"	Load across output	IRC STAC	MB-½	66-2223340	
418		Tube socket	Miniature (for "button" base tube) mica filled bakelite with riveting plate. Mounting holes ⅞" between centers; ⅝" hole for mounting. Amphenol Type 64-7PT (as made by The American Phenolic Corp., 1250 W. Van Buren St., Chicago, or equal). 1⅛" x ¾" x ¾" overall	Hold Tube VT-172	CINCH AMPH	64-7PT	257-6038	

Ref. No.	Signal Corps Stock No.	Name of Part	Description	Function	Supplier	Drawing Numbers		
						Supplier	Philco	Signal Corps
FREQUENCY METER BC-906-C—Continued								
419		Antenna	Extendible type; 8 3/8" collapsed, 20" extended. Base hole 0.171" dia., 13/16" deep. Mounting 0.375" dia., 1 1/8" long. 1st section 7 5/8" long; 0.218" diameter; 1/4" diameter ball on top of third section. Brass; copper nickel chromium bright finish. Telescopic sections to be smooth sliding	Pick up radiations	BSNY		358-1667	
420		Antenna socket support	Laminated phenolic Grade C or L; length 1 13/16"; Width, 5/8"; depth, 1". Hole for mounting antenna socket 3/4" deep in one end, 0.377" diameter. Mounting holes 0.5" apart in one end threaded 8-32 for 3/8". All cut edges to be coated with bakelite varnish	Hold antenna socket	SYNTH		257-7342	
421		Handle	Black leather with 3/4" nickel plated rings; 7" long. Gralnick Bros., Inc., Type 415. (As made by Gralnick Bros., Inc., 10th & Diamond Sts., Philadelphia, or equal.)	Carry instrument	GRAL		358-2017	
422		R-F choke	25 turns #34 DSC copper wire, 68 turns per inch. Ceramic form 0.250" x 13/16". Pigtail terminals 1.25" long. Wax impregnated and dipped. Using standard test jig, capacity difference between 6 and 12 megacycles is 223.25 mmf. ±5%. 1000 cycle inductance is 2.66 mh.	R-f isolating impedance	PC		352-1042	
423		Wiring panel	2-lug, 1 ground and mounting. Lugs plated, and riveted to insulating strip, which is 3/32" XXX bakelite or A.S.T.M. Grade 5 canvas bakelite, or equal, 7/8" long, 3/8" wide. 1/2" between lugs.	Wiring r-f choke	CINCH		358-2622	

LIST OF SUPPLIERS

Supplier Code	Supplier's Name and Address
AMPH	American Phenolic Corp., 1830 S. 54th St., Chicago, Ill.
AROV	Aerovox Corp., New Bedford, Mass.
AH&H	Arrow-Hart and Hegeman Electric Co., Hartford, Conn.
BSNY	Ben Snyder Corp., Noble and Darien Sts., Philadelphia, Pa.
BURG	Burgess Battery Co., Freeport, Ill.
CINCH	Cinch Manufacturing Corp., 2335 W. Van Buren St., Chicago, Ill.
CHIT	Chicago Telephone Supply Co., Elkhart, Ind.
CORDU	Cornell Dubilier Electric Corp., Hamilton Blvd., South Plainfield, N. J.
CH	Cutler-Hammer, Inc., 1333 W. St. Paul Ave., Milwaukee, Wis.
DEJA	De Jur Amsco Corp., Sheldon, Conn.
DRAKE	Drake Manufacturing Co., 1713 W. Hubbard St., Chicago, Ill.
ELUT	Electric Utilities, 2900 S. Michigan Ave., Chicago, Ill.
ELMO	Electric Motive Co., Willimantic, Conn.
ERIE	Erie Resistor Co., Erie, Pa.
GEND	General Dry Battery, 13000 Athens Ave., Cleveland, Ohio
GE	General Electric Co., Bridgeport, Conn.
GENR	General Radio Co., 30 State St., Cambridge A, Mass.
GRAL	Gralnick Bros., Inc., 10th and Diamond Sts., Philadelphia, Pa.
HAML	Hammerlund Manufacturing Co., 424 W. 33rd St., New York, N. Y.
IRC	International Resistance Co., 401 N. Broad St., Philadelphia, Pa.
KENR	Ken-Rad Tube and Lamp Corp., Owensboro, Ky.
KURK	Kurz Kasch Corp., Dayton, Ohio
MALLO	P. R. Mallory & Co., Inc., 3029 E. Washington St., Indianapolis, Ind.
MASM	Massachusetts Machine Shop, 817 Albany St., Boston, Mass.
MCAM	Micamold Radio Corp., 1087 Flushing Ave., Brooklyn, N. Y.
NATC	National Co., Inc., Malden, Mass.
OAK	Oak Manufacturing Co., 1260 Claybourn Ave., Chicago, Ill.
PC	Philco Corporation, C and Tioga Sts., Philadelphia, Pa.
SPRA	Sprague Specialties Co., North Adams, Mass.
STAC	Stackpole Carbon Co., St. Marys, Pa.
STWS	Stewart Stamping Co., 621 E. 216th St., New York, N. Y.
SYLV	Sylvania Electric Products, Inc., Emporium, Pa.
SYNTH	Synthane Corporation, Oaks, Pa.
TELR	Teleradio Engineering Co., 484 Broome St., New York, N. Y.
TUNG	Tungsol Lamp Works, 95 Eighth Ave., Newark, N. J.
UCIN	Ucinite Manufacturing Co., 459 Watertown St., Newtonville, Mass.
WILM	Wilmington Fibre Co., Box #1028, Wilmington, Del.

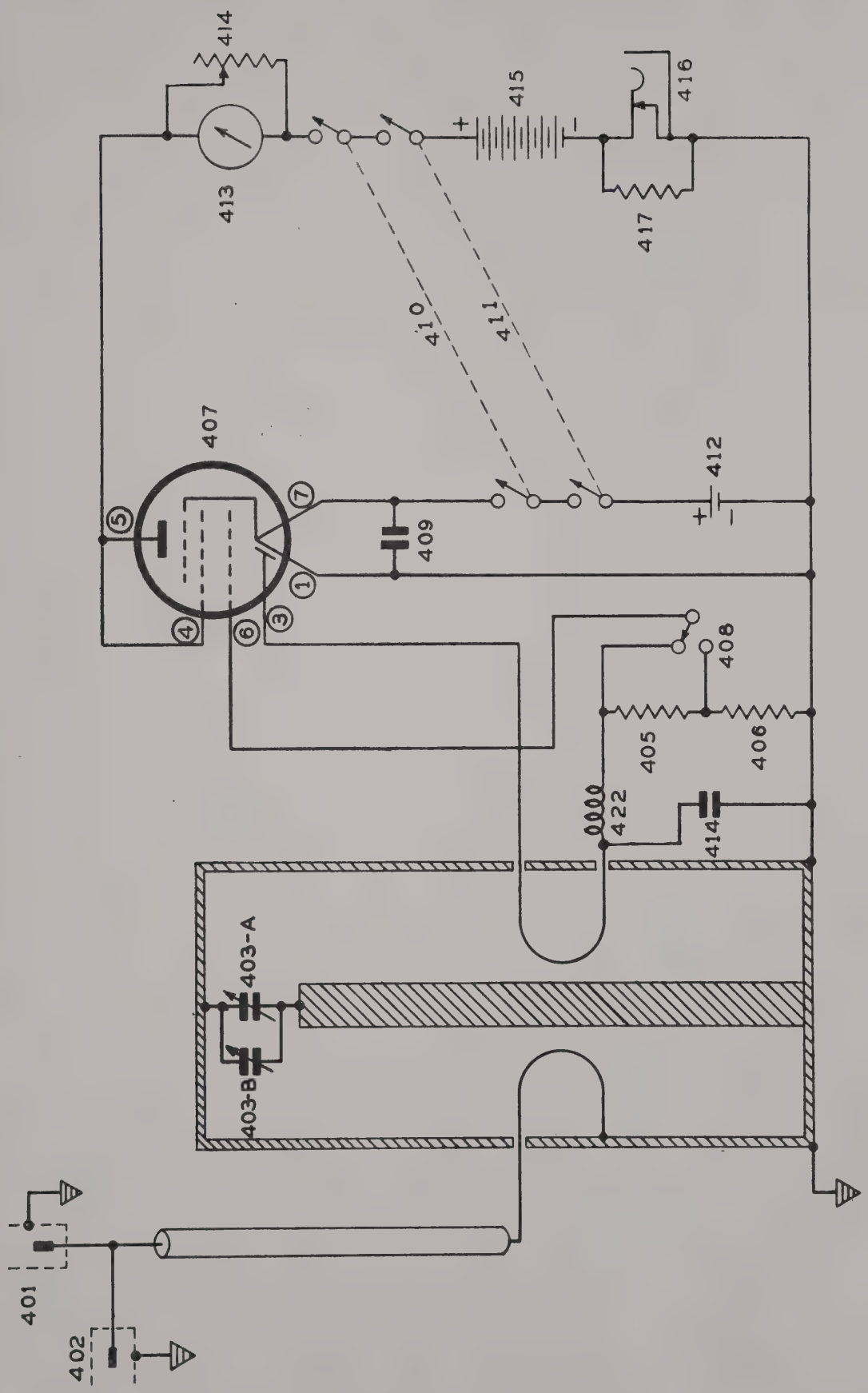

FIGURE 6—FREQUENCY METER BC-906-C, SCHEMATIC DIAGRAM

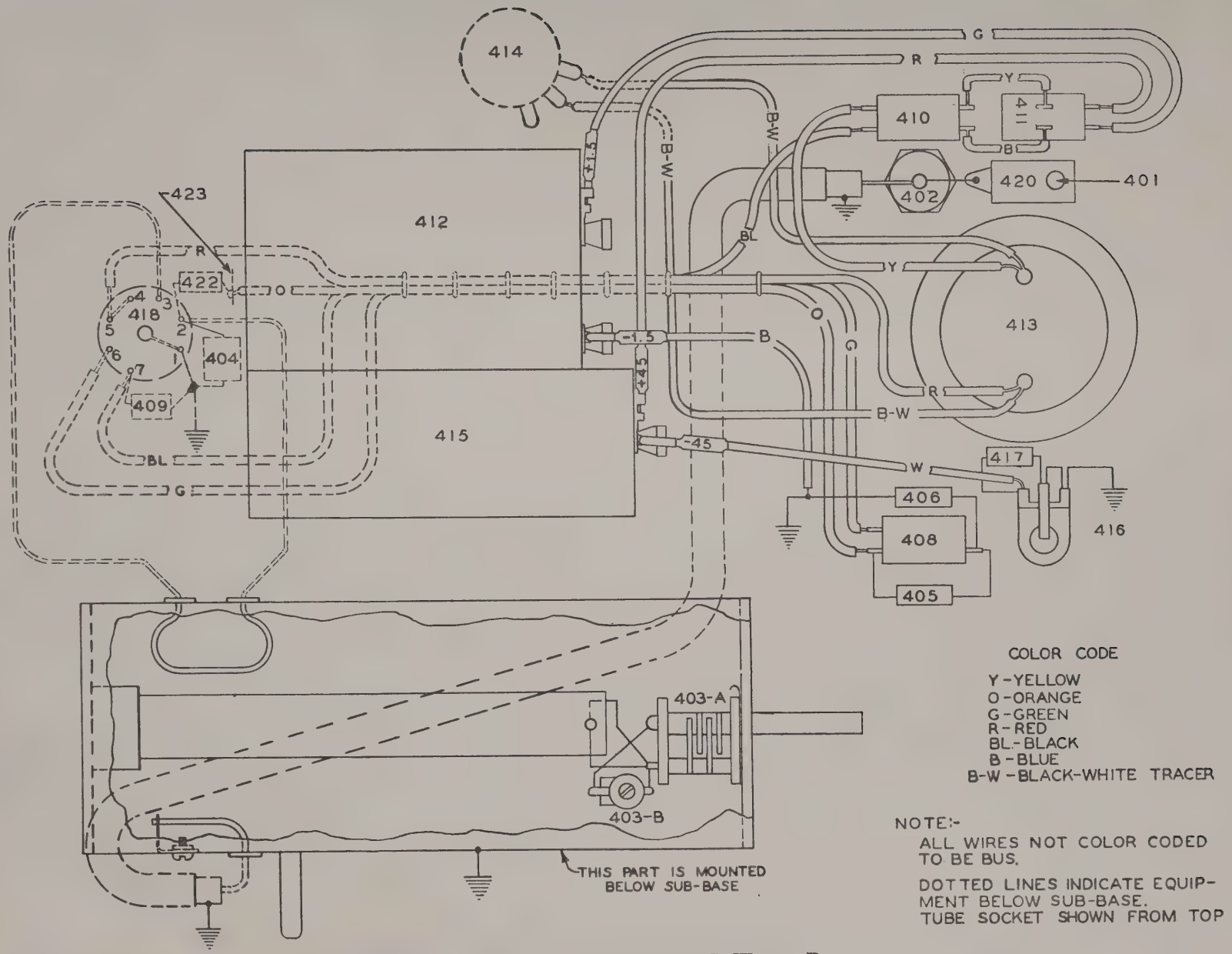

FIGURE 7—FREQUENCY METER BC-906-C, WIRING DIAGRAM

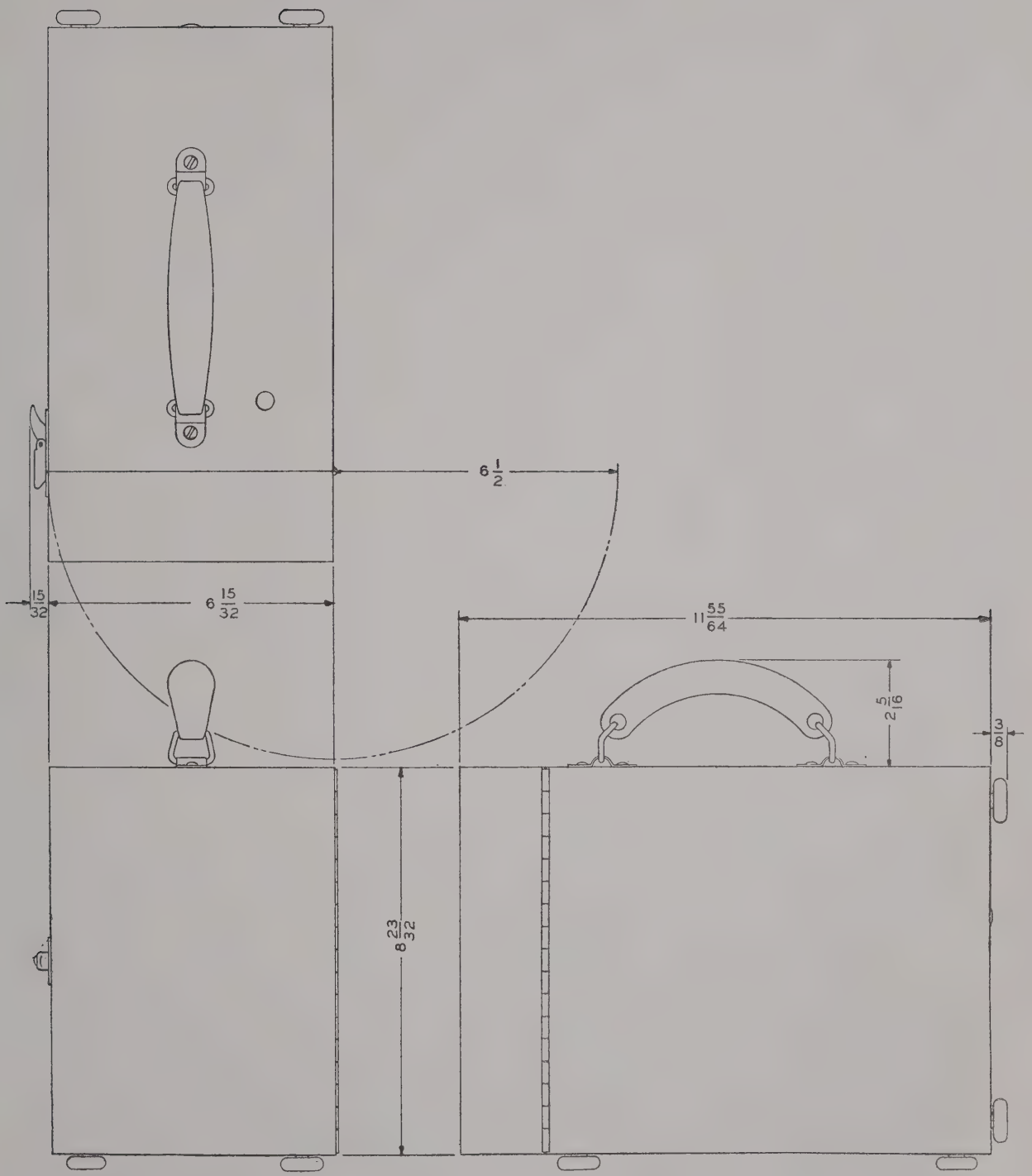

FIGURE 8—FREQUENCY METER BC-906-C, DIMENSIONAL DIAGRAM

Philco Part No. 359-3819-6860—12-42